DOCUMENT RESUME

ED 243 084 CS 007 583

AUTHOR Hogrebe, Mark C.; And Others
TITLE Are There Sex Differences in Reading Achievement? An Investigation with the High School and Beyond Data.
PUB DATE Apr 84
NOTE 25p.; Paper presented at the Annual Meeting of the American Educational Research Association (68th, New Orleans, LA, April 23-27, 1984).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Comparative Analysis; *Demography; Females; Grade 10; Grade 12; High Schools; Males; Predictor Variables; Private Schools; Public Schools; *Reading Achievement; *Reading Research; School Location; School Size; *Sex Differences; Socioeconomic Status

ABSTRACT

A study investigated the relationship between sex and reading achievement at the high school level. In addition, it examined the amount of variance in reading achievement accounted for by certain demographic variables, such as type of school, location of school, and socioeconomic status of students. Data for the study came from the High School and Beyond database compiled by the National Opinion Research Center. Information on more than 23,000 seniors and 24,000 sophomores was analyzed using multiple regression procedures. Results for both groups indicated that sex accounted for less than 1% of the variance in reading achievement, while demographic variables accounted for 20% of the variance in reading achievement for seniors and 22% for sophomores. The findings suggest that by the time students reach high school, virtually no sex differences exist in reading achievement. (Author/FL)

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ED243084

Are There Sex Differences in Reading Achievement? An Investigation with the High School and Beyond Data

Mark C. Hogrebe

Sherrie L. Nist

The University of Georgia

Isadore Newman

The University of Akron

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Paper Presented at the Annual Meeting of the American Educational Research Association

New Orleans, Louisiana

April 1984

CS007583

Abstract

The major purpose of this study was to investigate the relationship between gender and reading achievement at the high school level. A secondary purpose was to determine the amounts of variance in reading achievement accounted for by certain demographic variables. The data used for this study were drawn from the High School and Beyond data base. Information on 23,362 seniors and 24,678 sophomores were analyzed using multiple regression procedures. The results for both seniors and sophomores indicated that gender accounted for less than 1% of the variance in reading achievement and in five instances no significant relationships were found. Demographic variables accounted for 20% of the variance in reading achievement for seniors and 22% for sophomores. These findings suggest that by the time students reach high school, virtually no sex differences in reading achievement are present.

Surprisingly, there has been very little research investigating sex differences in reading achievement at the high school level. Studies which have been conducted on academic sex differences at the high school level have generally focused on differences in mathematical achievement (i.e. Benbow and Stanley, 1982; Pallas and Alexander, 1983) or on patterns of mental abilities (i.e. Backman, 1972) but not on reading specifically.

Several reasons for the paucity of research in this area are plausible. First, perhaps academic success at the high school level is viewed as being attributed to the construct called verbal knowledge which includes not only reading ability but also verbal reasoning, analogies, sentence completion, antonyms, and the like. Second, adequately investigating the issue of sex differences in reading achievement would require an extremely large data base (such as those used in the mathematical achievement studies) so as to reflect the total population of high schools in the United States. Tests that are used on a national level such as the SAT or the ACT, where a large data base would be available, do not reflect the total high school population since only those students who want to attend college tend to take the test. Hence, even with this available data base, researchers would still only be able to look at a restricted group. Finally, perhaps researchers feel that investigating gender differences in reading achievement at the high school level is a moot point in that reading is not taught as a specific subject at the high school level except to extremely deficient students.

While little research has investigated sex differences in reading achievement at the high school level, there is a body of research that supports the notion that girls have higher reading achievement at the elementary level (i.e. Gates, 1961), but that the gap narrows as students progress through the grades (Stroud and Linquist, 1942).

More recent studies have attempted to explain why the descrepancies exist. Contemporary explanations fall under one of four categories (Dwyer, 1974; Bank, Biddle, and Good, 1980)

1. Differential rate or level of maturation.
2. [Basal] reader content.
3. Negative treatment of boys by female teachers.
4. Cultural expectation for the male sex role.

Research investigating these reasons have yielded some interesting results. Asher and Markell (1974) found no significant differences in the reading achievement of boys and girls when the reading material was e
of high-interest, but girls outperformed boys on low-interest material. This finding is significant in light of the fact that elementary basal readers have been found to contain either stories which females find of higher interest than males (Heilman, 1967) or that many of the stories in the basals were thematically inappropriate for both sexes (Blom, Waite, and Zimet, 1968).

Johnson (1974) sought to determine if cultural expectations could explain why elementary boys tend to do poorer in reading than do girls. Subjects were selected from second, fourth, and sixth grades in each of four English speaking countries--United

States, Canada, Nigeria, and England. His findings indicated that in the USA and Canada, girls outscored boys on about three-fourths of the tests, and in England and Nigeria, boys did better than girls on about two-thirds of the tests. One explanation that Johnson offers for these findings is that in North American countries, reading is often characterized as a "feminine" activity, whereas in Nigeria parents wish their sons, not necessarily their daughters, to be academically successful. In England, educational success is valued by both sexes.

Finally, a classic study by Preston (1962) compared the reading achievement of fourth and sixth graders in German and American schools. He found that in USA girls outperformed boys in both grades, but that the exact opposite was found in the German schools. Preston notes that in the United States elementary schools, most of the teachers are women, whereas in the German schools, the majority of the teachers are men. Hence, boys in Germany have positive role models for reading behavior while females have positive role models in the USA.

The available data, then, suggest that sex differences in reading achievement do exist in the earlier grades; additional research attempts to explain why this discrepancy occurs. However, it remains unclear as to whether the gap narrows as Stroud and Linquist (1942) suggest or whether it widens as students progress through the grades.

Only a small number of studies could be located which specifically investigated the issue of sex differences in reading achievement

of high school students. Using scores from the Iowa Every-Pupil Test, Stroud and Linquist (1942) found that while girls had a higher mean score on reading comprehension subtests, the differences were less than one point on both tests. Additionally, when the scores on all tests from different areas were ranked according to the magnitude of sex differences reading comprehension was ranked last out of 12 tests.

A major research project undertaken by the International Association for the Evaluation of Educational Achievement (IEA) collected data on students in many countries. In analyzing the IEA reading comprehension data, Thorndike (1973) found low correlations between gender and reading scores. He also found that high school females showed a slight superiority in reading achievement but this superiority was not noteworthy.

Also using IEA data, Purves (1973) found that females statistically outperform males in literature. In attempting to explain the rather large gender differences among the literature variables, he examined the influence of both reading comprehension levels and interest. Even when controlling for reading comprehension, most of the sex differences in literature still remained. Purves attributed these differences to the interest factor.

Finn's (1980) data on sex differences in reading comprehension conflict with most of the other research in this area. He found no significant sex differences in reading comprehension during the first few school years but beyond the early years, girls consistently outperformed boys in reading comprehension.

When looking at the available research, the trend seems to be that gender accounts for very little of the variance in reading achievement. If this were also the case in the present study, we felt that looking at the amount of variance accounted for by certain demographic variables (school type, SES level, and region of the country) would be beneficial since these factors, especially SES, tend to correlate with reading achievement. Additionally, we also felt that it would be noteworthy to compare how much of the variance in reading achievement could be accounted for by sex with how much could be accounted for by specific demographic variables.

Research Questions

The purpose of this study was to examine the following questions:

1. Does gender account for a significant amount of variance in reading achievement at the high school level?
2. How much of the variance in reading achievement at the high school level can be accounted for by the demographic variables of region of the country, school type, and socioeconomic status?

Method

Data Base

Data reported in the present study came from a survey known as High School and Beyond (HSB) that was conducted by the National Opinion Research Center in 1980. This large data base is a rich source of information that allows for analyses of questions involving youth and education. Data are available for 28,240 sophomores and 30,030 seniors on 638 variables from 1,015 public and private schools across

the United States. A detailed description of the sample, sampling procedures, and tests can be found in other sources (Coleman, Hoffer, & Kilgore, 1982; NCES, 1982). Of the 58,270 students that comprise the HSB data base, 48,040 were used for the present study. The 10,230 students who were not included had missing data for one or more of the variables incorporated in this investigation. The current sample was composed of 23,362 seniors and 24,678 sophomores.

Demographic Variables

Gender. A student was coded 1 if male; 0 if female.

Region. The region of the country that a student came from was used to assess influences on reading achievement. There were nine regions of the country identified: New England, middle Atlantic, south Atlantic, east south central, west south central, east north central, west north central, mountain, and Pacific. The students in each region were sampled appropriately according to their proportion to all students in the country. For the purpose of the analyses, each region was coded as a separate categorical variable with a 1 indicating membership in the region and 0 otherwise.

School Type. The next demographic variable was the type of school in which the student was enrolled. The nine school types were, regular public, alternative schools, Cuban Hispanic public, other Hispanic public, regular Catholic, Black Catholic, Cuban Hispanic Catholic, Elite private, and other private schools. As with region, each school type was coded as a separate categorical variable with 1 indicating enrollment in a particular school and 0 otherwise.

Socioeconomic Status. The SES was a composite variable obtained by summing five standardized variables: father's occupation, father's education, mother's education, family income, and number of possessions (daily newspaper, encyclopedia, typewriter, electric dishwasher, 2 or more cars, more than 50 books, student's own room at home, and pocket calculator).

Criterion Variables

The criterion variables were the standardized scores of the reading achievement test on the vocabulary and comprehension sections.

Reading Achievement Tests

The test batteries used in the HSB study were designed by the Educational Testing Service under the direction of Thomas L. Hilton. A full description of the history and development of the battery as well as some basic technical data is available in the article by Heyns and Hilton (1982).

Reading achievement as defined in the present study consisted of vocabulary and comprehension sections. In the vocabulary subtest, the student had to identify for the target word, a synonym from a list of five words. The reading subtest was a "traditional" comprehension test in which the student was instructed to read a short passage and then answer a series of questions. The content of the passages included topics such as television, transportation, and astronomy. A typical passage had about 140 words. The student's task was to select an answer for each question from a list of five options which were based on information either stated or implied in the preceding passage. The results of the tests are reported in standard scores with a mean

of 50 and standard deviation of 10. The standardized scores were based on the raw scores which were corrected for guessing.

The senior reading tests consisted of two vocabulary sections of identical format but increasing difficulty and a reading comprehension section. Together, vocabulary parts 1 and 2 consisted of 27 items with a total testing time of 9 minutes. The reading comprehension subtests had passages, 20 items, and a testing time of 15 minutes. The standardized scores on the vocabulary subtests were added to get a senior vocabulary score. The standard scores for the senior vocabulary and senior reading comprehension were added to get a total reading achievement score. The internal consistency of the subtests (KR-20) were as follows: vocabulary part 1 (.75), vocabulary part 2 (.65), and reading comprehension (.80).

The sophomore reading tests were a vocabulary subtest of 21 items (testing time, 7 minutes) and a reading comprehension subtest of 20 items (testing time, 15 minutes). The standardized scores on the vocabulary and reading comprehension subtests were added to get a total reading achievement score. The internal consistency of the vocabulary subtest was .81 and for the reading comprehension subtest the internal consistency was .78.

The use of the vocabulary and reading comprehension subtests as measures of reading achievement is vulnerable to the argument that the limited number of items yield an inadequate sample of the skills needed for successful reading and comprehension at the high school level. This is a valid criticism since successful reading of connected discourse requires rather sophisticated learning and study strategies which are

not directly measured by the HSB reading tests. Although this is a valid criticism, the tests do assess skills and performance which are highly related to successful achievement in reading. Students with higher scores on the HSB vocabulary and comprehension measures will almost certainly be better readers than those with lower scores. The HSB tests produced data that are sufficient for examining group trends but they would be inadequate for individual diagnosis of reading processes.

Analyses

The data were analyzed using multiple regression in which the demographic variables were used to predict scores on sections of the reading achievement test. First, gender was examined in order to determine how much of the reading achievement variability it could account for. Second, the variables of region, school type, and SES were tested in order to determine the amount of variance they could account for in reading achievement.

The emphasis in the interpretation of the results for the present study is on the amount of variance accounted for in reading achievement by gender and the demographic variables. This approach was adopted since almost every very small difference was statistically significant due to the large sample size. Therefore, from the standpoint of making the interpretation of the results more meaningful an R^2 had to exceed .03 (small effect size) in order to be considered as having any potential practical significance. From a somewhat different perspective, the finding of nonsignificance with a data base as large as the present one provides evidence in support of accepting the null

hypothesis that there are no differences (Bobner & Newman, 1982). For example, with a sample of 4,000 an effect size of .0075 would be detected 95 out of 100 times. With a sample of 20,000, an effect size of .0015 would be detected 95 percent of the time. An R^2 of .0015 accounts for only 15% of 1% of the variance in the criterion variable which from a practical standpoint is rather meaningless.

The analyses were done separately for seniors and sophomores on each of the two reading achievement criterion variables. Subsequently, the seniors were divided into three groups: (1) those who scored one standard deviation above the mean on the total reading achievement test score, (2) those who scored one standard deviation below the mean, and (3) the remaining middle group. The analyses outlined above were performed within these high, medium, and low groups, as well as for the total senior group. This same grouping procedure was conducted for each criterion variable. In additon, the overall process was completed for sophomores.

Results

The means and standard deviation of the standardized reading scores of the seniors and sophomores are listed in Tables 1 and 2, respectively. Since the mean of a single subtest was 50 and the standard deviation was 10, the expected mean and standard deviation for the sum of two subtests were 100 and 20. Likewise, the expected mean and standard deviation for the sum of three subtests were 150 and 30.

Insert Tables 1 and 2 about here

The results are reported in Table 3 for seniors and Table 4 for sophomores. Gender accounted for less than one percent of the variance in each of the reading achievement test scores. This lack of relationship between gender and reading scores occurred for both seniors and sophomores at every ability level.

Insert Tables 3 and 4 about here

In order to emphasize further the lack of relationship between gender and reading test scores, it should be pointed out that in several instances there were no statistically significant relationships between gender and reading test scores. As discussed previously, the power of statistical tests with sample sizes as large as the present ones was extremely high and virtually any difference was statistically significant. When statistical significance is not found with enormous samples then there is evidence to suggest acceptance of the null hypothesis of no relationship or difference. In addition to the finding that gender accounted for less than one percent of the variance in the reading test scores in every case, there were five instances in which there were no statistically significant relationships. In each of these cases, gender accounted for less than .02 percent of the variance in the reading scores. These five instances are identified in Tables 1 and 2.

Although the strength of the relationships between the demographic variables and reading achievement appeared to be a function of the range

of scores, the data suggested that the relationships were significant. For the total group of seniors, the demographic variables of school type, region of the country, and SES accounted for almost 20% of the variance in reading achievement scores. For all the sophomores, the demographic variables accounted for almost 22% of the variance in reading achievement scores. The percentages of variance accounted for in the reading scores by the demographic variables for the middle senior and sophomore groups were 8.1% and 7.9%, respectively. The decreases in percentages of variance accounted for from the total groups to the middle groups were almost certainly due to a reduction in the range of scores. Likewise, there were reductions in the percentages of variance accounted for in the reading scores when the groups that were one standard deviation above or below the mean were examined separately.

Finally, there was a trend for the demographic variables to account for more variance in the vocabulary scores than in the passage comprehension scores. This trend held for both the senior and sophomore total groups and their subgroups. The most pronounced difference was for the sophomore total group in which the demographic variables accounted for approximately 22% of the variance in the vocabulary score in comparison with about 15% in the passage comprehension score.

Discussion

The results of this study strongly support the notion that there are virtually no sex differences in reading achievement by the time students reach high school. While previous research suggested that females generally perform better than males on tests of reading ability

during the elementary years (i.e. Gates, 1961), the HSB data show that the gap closes at the high school level. Gender failed to account for even 1% of the variance in reading achievement at any level.

The vocabulary and comprehension tests used in the HSB study were designed to get a general picture of the reading achievement of the "average" high school student. The type of reading skills assessed might be considered as a set of the broader range of literacy skills possessed by the average high school student. The tests were not designed to assess higher level verbal aptitude which would include items such as verbal reasoning and analogies. The HSB data suggest that there are no significant gender differences in reading achievement scores on the basis of tests which do not emphasize advanced abstract verbal thinking. In other words, the results indicate that both males and females reach comparable levels of achievement in vocabulary and comprehension by the time they reach high school.

It is important to distinguish the results of this study from reports of gender differences on verbal aptitude measures such as the Scholastic Apritude Test (SAT). According to a recent College Board report (1983), the average SAT verbal score for males was 430 while the average for females was 420. These figures indicate that males perform slightly better than females on this measure of verbal aptitude. However, these findings should not be compared to the present results because the composition of the verbal aptitude test is different from the HSB reading achievement tests. Moreover, the HSB data attempted to be representative of the entire U.S. high school population, but the SAT is taken by only 1 out of 3 high school

students (College Board, 1983). It is probable that those who took the SAT were not representative of all high school students.

In the search for gender differences on the HSB reading achievement tests, the senior and sophomore groups were each divided into high, middle, and low groups based on the total reading achievement score. It was anticipated that gender differences might be more pronounced for various achievement levels. For example, past research indicated that the gender gap in reading achievement for younger children was most pronounced in low achieving students (Durrell, 1940; Mumpower, 1970). As stated previously, however, there were no gender differences, from a practical standpoint, at any level. Evidently in high school, males and females have comparable reading achievement regardless of the overall level of that achievement.

For both of the total groups of seniors and sophomores, selected demographic variables demonstrated rather strong relationships to reading achievement. The effect sizes (Cohen & Cohen, 1975, p. 145), which are the ratio of variance accounted for to variance unaccounted for, approached the high range (.25-.28). Although the purpose of this study did not include untangling the effects of school type, region of the country, and socioeconomic status in the prediction of reading achievement, the present results indicated that these demographic variables as a group were highly correlated with reading achievement. In contrast to the finding that there were no pragmaticly significant gender differences in vocabulary and comprehension across a wide range of reading achievement levels, there were selected demographic variables which did relate rather strongly to the level of reading achievement.

Being a male or female did not influence a student's attainment of reading skills at the high school level, but possessing a certain combination of demographic characteristics probably did have some bearing on reading achievement.

In conclusion, the HSB data did not support the notion that there were gender differences at the high school level in attaining an average level of reading achievement. However, the demographic variables of school type, region of the country, and socioeconomic status were significantly related to reading achievement in high school.

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Table 1

Means and Standard Deviations of Senior Reading Achievement Scores

	N	Vocabulary[b] M	Vocabulary[b] SD	Comprehension[a] M	Comprehension[a] SD	Total[c] M	Total[c] SD
Male	11,044	101.0	18.9	50.1	10.3	151.1	27.3
Female	12,318	98.7	18.0	49.6	9.8	148.3	25.9
One SD Above M							
Male	2,204	129.2	9.2	62.5	4.9	191.8	10.9
Female	1,963	128.4	9.1	62.4	4.8	190.9	10.6
Middle Group							
Male	6,950	98.7	10.7	49.8	7.5	148.5	14.7
Female	8,165	97.5	10.8	49.8	7.2	147.3	14.7
One SD Below M							
Male	1,890	76.8	6.4	36.5	4.9	113.3	7.1
Female	2,190	76.6	5.9	37.3	4.7	114.0	6.6

Note:

[a]Standarized scores with a mean of 50 and standard deviation of 10.

[b]Sum of vocabulary parts 1 and 2 with an expected mean of 100 and standard deviation of 20.

[c]Sum of vocabulary parts 1 and 2 and comprehension subtest with an expected mean of 150 and standard deviation of 30.

Table 2

Means and Standard Deviations of Sophomore Reading Achievement Scores

	N	Vocabulary[a] M	Vocabulary[a] SD	Comprehension[a] M	Comprehension[a] SD	Total[b] M	Total[b] SD
Male	11,644	51.3	9.9	51.0	10.2	102.3	18.7
Female	12,984	49.9	10.1	50.1	9.9	100.0	18.5
One SD Above M							
Male	2,254	64.2	4.7	65.8	4.9	130.0	7.0
Female	2,117	64.1	4.6	65.4	4.9	129.6	6.8
Middle Group							
Male	7,422	51.0	6.4	50.0	6.6	100.9	10.3
Female	8,262	50.3	6.8	49.8	6.4	100.0	10.5
One SD Below M							
Male	1,968	37.7	4.4	38.3	4.1	76.0	5.1
Female	2,605	37.1	4.3	38.7	4.0	75.8	5.0

Note: [a]Standarized scores with a mean of 50 and standard deviation of 10.

[b]Sum of the vocabulary and comprehension subtests with an expected mean of 100 and standard deviation of 20.

Table 3

The Relationships of Gender and Demographic Variables to Reading Achievement for Seniors

	Gender	Demographic Variables
One *SD* Above *M* (*n* = 4,167)		
Vocabulary	.0019	.0393
Comprehension	.0000^{ns}	.0189
Total	.0017	.0449
Middle Groups (*N* = 15,115)		
Vocabulary	.0032	.0694
Comprehension	.0000^{ns}	.0415
Total	.0016	.0809
One *SD* Below *M* (*n* = 4,080)		
Vocabulary	.0001^{ns}	.0155
Comprehension	.0069	.0087
Total	.0025	.0196
Total Group (*n* = 23,362)		
Vocabulary	.0040	.1897
Comprehension	.0005	.1485
Total	.0027	.1996

Note: Table entries are R^2s for either gender or the demographic variables predicting reading achievement scores.

ns = Not statistically significant. All other entries are statistically significant due to the large sample.

Table 4

The Relationships of Gender and Demographic Variables to Reading Achievement for Sophomores

	Gender	Demographic Variables
One *SD* Above *M* (*n* = 4,371)		
Vocabulary	.0001[ns]	.0734
Comprehension	.0012	.0195
Total	.0009	.0618
Middle Group (*n* = 15,684)		
Vocabulary	.0028	.0911
Comprehension	.0001[ns]	.0261
Total	.0017	.0790
One *SD* Below *M* (*n* = 4,573)		
Vocabulary	.0054	.0308
Comprehension	.0019	.0069
Total	.0008	.0206
Total Group (*n* = 24,678)		
Vocabulary	.0050	.2215
Comprehension	.0021	.1549
Total	.0040	.2162

Note: Table entries are R^2s for either gender or the demographic variables predicting reading achievement scores.

ns = Not statistically significant. All other entries are statistically significant due to the large sample.